Next exam in 2 weeks.
Program was graded and returned.
Program will be posted later today.
HW due today (midnight).

Announcements:

CS 180 - Trees
Some structures require more complex relationships.

All data structures so far have

Ch 6 - Trees
Programs 109

CS 145 150

Fall 08 Spring 09 Fall 09

WWW CS 146 CS 145 150 CS 180

Examples: File Systems

File Systems
A tree is a set of nodes storing elements in a parent-child relationship. Each node (except root) has a unique parent. The root node is the special node.
Descendants

- Ancestors
- Rooted subtree
- Internal nodes
  - Leaves - no children
  - Parent
  - Siblings - share common child

More on this...
Node Structure:

- Parent Pointer
- Data or Element
- Nodes or Elements
- Size
- Pointer to root or root node

Pre-order Code:

- Count # of children
- List of each of child pointers

Free class needed?

What sort of data weight a

Tree ADT (from book)
Tree functions:

- `parent(v)`: return the parent of `v`.
- `root(v)`: return a root node (or iterator) for `v`.
- `children(v)`: return list of children of `v`.
- `get_first_child(v)`: return first child of `v`.
- `get_next_sibling(v)`: return next sibling of `v`.
is Root (√)

is Leaf (√)

is Internal (√)

More Functions:
replace Element (V) element

replace WWW with public.html

swap Elements (V, W) : switch contents

site (): return # of nodes
To actually traverse a print out

Most are O(n).

What is running time of previous

Basic Algorithms

Take linear time – O(n).

Consider all the threads would
Easy to give recursive

\[ \text{depth}(v) = \text{depth}(\text{parent}(v)) + 1 \]

Each other node:

\[ \text{depth}(v) \]

Root has depth 0.

Defined recursively.

Computing Depth
The size of a subtree rooted at \( v \) is \( 0 \) if \( v \) is a leaf.

The height leads to recursion.

For a tree, the height of a child node is the maximum of the heights of its children, plus 1.

The height of a root is at least 0.

Computing height:\n
\[
\text{Height}(v) = \max(\text{Height}(v_1), \text{Height}(v_2)) + 1
\]